HETEK FLOW SAMPLER

User Manual

Version 1.7 – July 2023
Document #6.11

Our Solutions. Your Safety.

Revision History

Rev #	Date	Revised By	Detail
1.1	May 6th, 2022	Ashwin Mohan	New SPP
1.2	Aug 4th, 2022	Ashwin Mohan	Update of Specification - Blower Flow Rate
1.3	Dec 23rd, 2022	Ashwin Mohan	Update of Sections 1, 3, 4, 10, 12, 13 to include updated imagery, warning messages, and specifications in accordance with certification
1.4	Jan 19th, 2023	Ashwin Mohan	Addition of grounding for electrostatic hazards
1.5	Mar 20th, 2023	Ashwin Mohan	Certification nomenclature added
1.6	April 24th, 2023	Ashwin Mohan	Best Practices for Battery and Screen Messages
1.7	July 25th, 2023	Ashwin Mohan	ATEX Certification nomenclature added

Contents

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1. Introduction

The Hetek Flow Sampler is a field based, portable, battery-powered instrument designed to determine the volumetric flow rate of gas leaks or fugitive emissions around various above grade natural gas infrastructure such as pipe fittings, valve packings, and compressor seals. Settings include facilities such as natural gas storage, compressor stations, pressure regulation stations, and industrial facilities. Produced by Hetek Solutions Inc. ("Hetek"), the Hetek Flow Sampler is certified for intrinsic safety for use in hazardous locations according to applicable regulatory standards across North America (see *Section 4, Table 1* for more details).

1.1 Specified Use

The Hetek Flow Sampler (also referred in this document as the "instrument" or "HFS") is a gas leak quantification device. Typically used in facilities containing natural gas infrastructure, it quantifies the leak by sampling at high flow rate(s) to capture all the gas leaking from the component along with surrounding air. By measuring the flow rate of the sampling stream and the natural gas concentration within that sample stream, the gas leak rate is calculated using *Equation 1* and outputted as parameter – Q_{LEAK} on the instrument display.

The Hetek Flow Sampler is meant to be used after a gas leak detection survey has been conducted using approved methods for the purposes of pinpointing the source of the leak such as using a portable gas detector or optical gas imaging (OGI) camera. Once the leaking components have been identified, the user can measure the rates of those leaks using the Hetek Flow Sampler with knowledge of the exact leaking component, thus being able to accurately capture the leak using appropriate accessories.

The instrument is packaged and operated while it is inside a padded backpack, enabling the operator to carry it especially when climbing ladders or entering a confined space. The handheld display allows the user to perform the instrument's main functions which is connected via a 6-foot coiled cable.

⚠ **WARNING:** The Hetek Flow Sampler is not to be used in any application that is beyond its intended purpose or beyond the scope of its specifications. Failure to adhere to this warning can result in personal injury, damage to the equipment, or reduced instrument performance.

⚠ **WARNING:** The Hetek Flow Sampler is not a life safety device meant for the personal protection of the user or others. A multi-gas personal safety monitor is to be used in conjuncture with the Hetek Flow Sampler to warn the user of hazardous gases that could be present in the area.

⚠ **WARNING:** Use only the following battery pack.

- Hetek battery pack – Part Number 1840-1003
- Hetek approved battery packs are supplied with an identifying label
- Replacement or additional battery packs supplied by Hetek

⚠ **WARNING:** Use of unauthorized parts will void certification and warranty of the device.

$$Quantified\ Leak = Flow\ Rate\ \times \left(Gas_{sample} - Gas_{\ Background}\right) \times 10^{-2} \qquad (Eq.1)$$

where:

Quantified Leak =	rate of gas leak from source (cfm or lpm)
Flow Rate =	blower flow rate (cfm or lpm)
Gas_{sample} =	concentration of gas from leak source (%)
$Gas_{background}$ =	background gas concentration (%)

$$1 - 2\ (\%) = \left|\frac{Q2_{LEAK} - Q1_{LEAK}}{Q2_{LEAK}}\right| \times 100 \qquad (Eq.2)$$

Equation 2 is used to calculate the difference in the Q_{LEAK} values after a 2-stage test. It served as an indicator of the quality of sample that was collected with differing blower flow rates. The $Q_1 – Q_2$ (%) value will be displayed on the results screen at the end of each 2-staged test and outputted in the data log file.

1.2 Actual and Standard Quantities

The final quantification output of the leak will be an actual quantity which is affected by field conditions. A standard quantity considers temperature and pressure conditions. If a standard quantity is desired, then *Equation 3* will be required to convert the final Q_{LEAK} value in relation to standard temperature and pressure. This calculation to be tabulated separately by the user.

$$SCFM = ACFM * \left(\frac{P_{ACTUAL}}{14.7psi}\right) * \left(\frac{528^{\circ}R}{T_{ACTUAL}}\right) \qquad (Eq.3)$$

where:

SCFM = standard cubic feet per minute
ACFM = actual cubic feet per minute – Q_{LEAK}
P_{ACTUAL} = barometric pressure (psi)
T_{ACTUAL} = temperature in Rankine (°R)

T_{ACTUAL} and ACFM are both outputs from the Hetek Flow Sampler, on the display after a measurement is complete and on the **DATA LOG** file on a computer when logging is enabled.
P_{ACTUAL} can be obtained from local weather station (station pressure).

Please Note: *Equation 2* uses standard temperature at 528°R (20°C or 68°F). Variations exist.

1.3 Other Conversions

Various fugitive emissions management programs require reporting in other units or parameters. The following formulas aim to achieve that, and their descriptions are as follows: *Equation 3* is the conversion from imperial to metric units, *Equation 4* yields the annual metric volume, and *Equation 5* is the conversion between the temperature units Rankine and Celsius.

$$SCMM = SCFM \times (0.028317\ scm/scf) \qquad (Eq.4)$$

$$\frac{SCM}{year} = SCMM * \left(\frac{60min}{hr}\right) * \left(\frac{8766hr}{yr}\right) \qquad (Eq.5)$$

Where:

SCM = standard cubic metre
SCMM = standard cubic metre per minute

$$T_{\circ R} = (T_{\circ C} + 273.15) \times 1.8 \qquad (Eq.6)$$

2. Standard Materials

The following materials are included in every Hetek Flow Sampler unit (P/N 1840-0000):

- Main Unit
- Quick Guide
- Backpack and Accessory Bag (1840-0058)
- Batteries – Qty. 2 (1840-1003)
- Charger (1840-0100)
- Crevice Tool (see *Figure 1*) (1840-1082)
- Cone Collection Tool (see *Figure 2*) (1840-0061)
- Sample Collection Bag (see *Figure 3*) (1840-0059)
- 6-foot hose (1840-2004)
- 12-foot hose (1840-2005)
- Flange Tool (see *Figure 4*) (1840-0060)
- Communication USB cable (1840-1067)
- Grounding Clamp and Cable (see *Figure 5)* (1840-0064)
- Firmware Upgrade Kit (1840-1112, 1840-1113, 1840-1114)

2.1 Optional Items

The following optional items are available and can be ordered separately (Hetek part #):

- Cotton Filters for Sensors (Box of 10) (6100-6119)
- Inlet Filter (1840-1001)
- Calibration Kit: Regulators, Case, Gases (Available in North America only) (1840-0013)
- Batteries (1840-1003)
- Charger (1840-0100)

3. Attachments

The Hetek Flow Sampler comes with four (4) attachments that enables the user to capture leaks from various fittings, locations, and positions. The appropriate attachment must be selected by the user and attached to the end of the instrument's hose assembly (either the 6-foot or 12-foot hose can be used), of which the hose's other end is attached to the inlet, located at the top of the instrument.

⚠ **WARNING:** Attachments can have the effect of concentrating the leak. Ensure that enough air is present at first when sampling to support catalytic mode of the sensor. Flooding the sensor with high concentrations of methane in the beginning can result in erroneously low readings and prevent transition to thermal conductivity mode.

3.1 Crevice Tool (Part #1840-1082)

Used when the leak source is confined to a narrow space.

Figure 1. Crevice Tool

3.2 Cone Collection Tool (Part # 1840-0061)

A tool meant to be used over small fittings and vents.

Figure 2. Cone Collection Tool

3.3 Sample Collection Bag (#1840-0059)

A durable collection bag that is versatile enough to be used over various fittings, over components that contain multiple leak sources in a small area or that is hard to pinpoint or access. Once the sample collection bag is over the leaking component, use the drawstring to close the end of the bag.

Figure 3. Sample Collection Bag

⚠️ **WARNING:** Do not close the off the bag completely, allow air to flow into the bag to replace the volume of gas and air being removed because of the instrument's intake during the test.

3.4 Flange Tool (Part #1840-0060)

Wrap the flange tool over a flange and ensure that the hose is connected to the flange tool at the top of the flange to best capture the leak as natural gas is lighter than air.

Figure 4. Flange Tool

Tip: At high leakage rates or when the ability to capture all fugitive emissions from a leaking source is unknown, it is recommended to use an optical gas imaging (OGI) camera to view the measurement being conducted. This ensures that all gas has been captured by an attachment used with the HFS.

4. Specifications

Table 1. Technical Datasheet

Specification	Detail
Product	Hetek Flow Sampler
Manufacturer	Hetek Solutions Inc. 2085 Piper Lane, London, ON N5V 3S5 Canada
Display Information	• Date and Time • Blower flow rate • Battery Level • Difference between 2 stages • Sample Concentration • Leak Temperature • Background Concentration • Quantified Leak Rate
Display Screen Size	3-inch LCD Display
User Controls	4 Pushbutton keys: ESCAPE; ↑ (up arrow); ↓ (down arrow); ENTER
Data Output	Data log file and Calibration log file (.CSV format)
Memory	800 records for Data; 1000 records for Calibration
Communication	USB cable from Hetek Flow Sampler to a digital device
Measured Values	• Blower Flow Rate • Sample Gas Concentration • Battery Level • Background Concentration
Calculated Values	• Quantified Leak (Stages 1 and 2) • Difference between stage 1 and stage 2 (Automatic and Manual)
Humidity	0 – 95% relative humidity (non-condensing)
Operating Temperature	- 20°C to 40°C (-4°F to 104°F)
Storage Temperature	- 20°C to 45°C (-4°F to 113°F); - 40°C to 90°C (without battery)
Blower Flow Rate	Maximum ≈ up to 9.0 CFM (255 LPM) at full battery charge Stage 2 is 70 – 80% of the flow rate of Stage 1
Sensor	Catalytic Oxidation Mode: 0 to 5% by volume methane Thermal Conductivity Mode: 5 to 100% by volume methane
Leak Measurement	1.5 – 140 LPM (0.052 – 5.0 CFM) : Automatic 2-Stage & Manual 2-Stage 0.5 – 140 LPM (0.017 – 5.0 CFM) : Manual 1-Stage
Battery	Standard Quantity: Two (2) with every Hetek Flow Sampler 4.8 V Nickel-Cadmium Rechargeable Battery Run Time: 5 hours (per battery); Recharge Time: 12 hours
Electrical Parameters	U_m = 5.36 V; P_i = 15 W; L_i = 50 µH, C_i = 100 µF
Weight	Enclosure with Display: 19.90 lbs (9.05 kgs)
Dimensions	Enclosure: 12” L x 16” H x 7.5” D (30.48 cm L x 40.64 cm H x 19.05 cm D)
Flow Measurement	Differential pressure across orifice
Accuracy	Sensor: ± 5% Flow Rate: ±5% Calculated Leak Rate: ±10%
Certified against the following standards and classification ratings for intrinsic safety in hazardous locations across North America and Europe	CSA C22.2 No.60079-11 (2nd edition), CSA C22.2 No. 60079-0 (4th edition) UL 60079-0 (7th edition), UL 60079-11 (6th edition), UL 913 (8th edition) IS Class I, Division 1, Group D, T3 Class I, Zone 0 AEx ia IIA T3 Ga Ex ia IIA T3 Ga CE 2900 Ex II 1G Ex ia IIA T3 Ga

5. Grounding

Static discharges can be controlled by proper static bonding and grounding wherever flammable gases and dusts are present. The goal of static bonding and grounding is to safely remove built-up static electricity without having a static discharge event. This is achieved by attaching grounding clamps, that are bonded to a terminal point on the Hetek Flow Sampler via a spiral cable and lug, to a known and verified ground point in the field such as a grounding rod or cable.

Please Note: In order to prevent a spark while grounding, it is recommended to first ground the equipment prior to switching the Hetek Flow Sampler ON. When not in use, the grounding clamp should be stored inside the backpack.

5.1 Grounding Clamp and Cable Assembly (Part #1840-0064)

⚠ **WARNING:** The enclosure must be protected to avoid ignition hazard due to impact or friction.

- The device must be protected from high electrostatic charge environments and processes.
- In cases where electrostatic conditions are unknown, the device must be protected with a dissipative guard.
- To reduce the possibility of a static discharge, the Hetek Flow Sampler must be grounded while conducing a leak measurement.

Figure 5. Hetek Flow Sampler with Grounding Clamp and Cable Assembly

⚠ **WARNING:** The ground clamp may experience wear over time such as dulling of its contact points and weakening of its spring, which can lose its overall functional effectiveness over time. In such an event, it is recommended to replace it with Hetek Part #1840-0064, as this component is specifically designed for grounding with its strong spring and sharp contact point to penetrate any coating and/or rust to reach the underlying metal as well as to attach itself firmly to the grounding material.

6. Operation

⚠ **WARNING:** The instrument must be turned ON in a clean atmosphere, or upwind from a hazardous area. The battery must be connected and disconnected in a non-hazardous area.

The instrument is switched on using the ON/OFF toggle switch. This initiates the start up sequence. The start up sequence involves:

- Hetek Logo
- Product Name and Firmware version
- Calibration Due Reminder
- Purging of sensors

6.1 Display

A 3-inch, LCD screen will be the main user interface for the instrument's functionality navigation. The screen comes with a pair of magnets on the back, which is meant to assist the user in performing measurements hands-free, by placing the display on a ferromagnetic material such as a pipe or ladder.

Figure 6. User Interface

The instrument is operated using the 4 buttons present on the user interface, display module. The buttons and their functionalities are as follows:

- **ESCAPE:** exits out of the menu or function
- **↑:** Increasing/next selection
- **↓:** Decreasing/next selection
- **ENTER:** selects the option highlighted

Please Note: The ↓↑ keys will advance the menu selection in increments in the same direction. The cursor will appear on one line of the screen and always highlighted in dark pixels.

6.2 Verification Test

After purging during start-up, the user should perform a verification test once before daily operational use by selecting the option **VERIFY** present in the **CALIBRATION** menu to validate the output of the sensors against a known sample of certified gas. It is recommended to verify using methane or natural gas with a balance of air from a certified cylinder of 2.5% volume of gas. Air is required because the presence of oxygen is required for the sensor to operate in the catalytic mode (0 – 5% Vol. gas in air).

When the instrument has not been calibrated for over 30 days, it will prompt a warning for "Calibration Overdue" as seen in *Figure 6*. The user will be required to perform a calibration to remove this warning. Additional information regarding calibration will be in *Section 8: Calibration*.

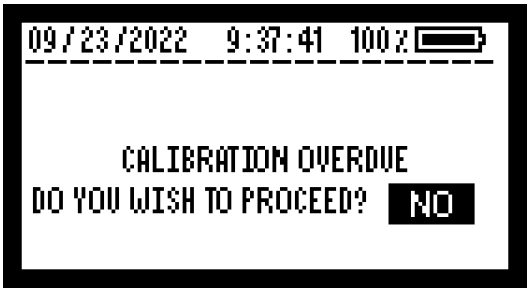

Figure 7. Calibration Overdue Message

The user can select the **ESCAPE** key to exit out of the calibration menu onto the main menu.

6.3 Main Menu

The main menu will showcase the Background (%), Sample (%), Leak (^{o}C or ^{o}F), Blower Rate, Status Line, and the **START** option at the bottom of the display that is highlighted with a dark background. Upon selection, using the **ENTER** key this for the **START** option will proceed to begin a measurement test.

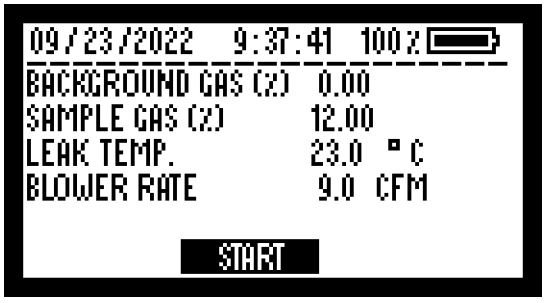

*Figure 8. Selector on **START***

When selecting the ↑ or ↓ arrow keys at the main menu, the **SETTINGS** option is displayed. Upon selection using the **ENTER** key this for the **SETTINGS** option the sub-menu has the following options:

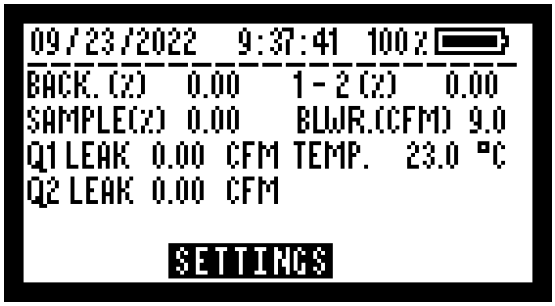

*Figure 9. Selector on **SETTINGS***

1. **Flow Units:** offers the ability to change units of measurement and output
    a. Cubic Feet per minute (CFM)
    b. Liters per minute (LPM)

2. **Temp. Units:** ability to change units of temperature
    a. Celsius °C
    b. Rankine °R
    c. Fahrenheit °F

3. **Calibration:** verification testing, calibration, and deletion of records
    a. Verify
    b. Calibrate Sensor
    c. Erase Previous Calibration Log
    d. Erase Entire Calibration Log

4. **Data Upload:** the user can select either data or calibration file to be uploaded at a time
    a. Data Log
    b. Calibration Log

5. **Purge:** a manual purge function to clear out all gas from the instrument
    a. Start/Stop: displays the background gas and sample gas percentages

6. **Erase Data Log:** data log can be deleted by user

7. **Set Time/Date:** adjust date/time in the location of the measurement occurrence

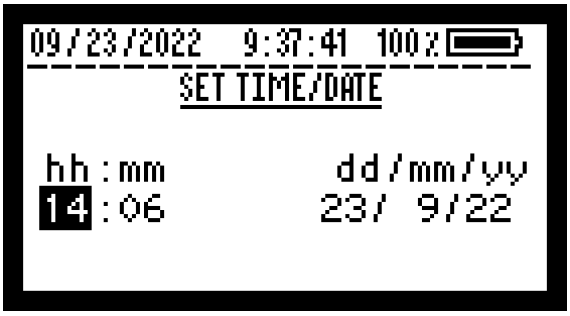

Figure 10. Setting the date/time

8. **Access Records:** enables the user to access records in the field for a limited number of tests (6).
    a. Calibration Records
    b. Leak Test Records

6.4 Measurement Test Overview and Modes

Typically, two measurements are performed at different flow rates (automatic 2-stage and manual 2-stage modes) to ensure that the instrument is capturing all the gas that is escaping from the component. The first measurement is taken at the highest possible flow rate, followed by a second measurement at a flow rate that is approximately 70–80% of the first. If the two calculated leak rates are within 10% of each other, then it can be assumed that all gas has been captured during the test.

The gas sample is drawn into the instrument through a flexible hose with various attachments that are to be connected to the end of the hose based on the attachment's ability to encapsulate the leaking component.

Please Note: The background gas sample line (clear tubing that is attached to the sampling hose end by the inlet of the instrument) must be connected to the **BACKGROUND** port on the instrument when performing the tests.

The main unit consists of a blower that draws in air from and around the component being tested through a flexible hose and into the instrument. The sample is first passed through an orifice restrictor where the measured pressure differential is used to calculate the sample's actual flow rate. Next, a portion of the sample is drawn in and directed to a combustible sensor that measures the sample's methane concentration. A second identical combustible sensor channel measures the background methane level within the vicinity of the leaking component. The final element in the sampling system is a blower that exhausts the gas sample back into the atmosphere away from the sampling area. The measured flow rate and the measured methane levels (both sample and background levels) are used to calculate the leak rate of the component being tested, with all measured and calculated values being displayed on the hand-held display unit.

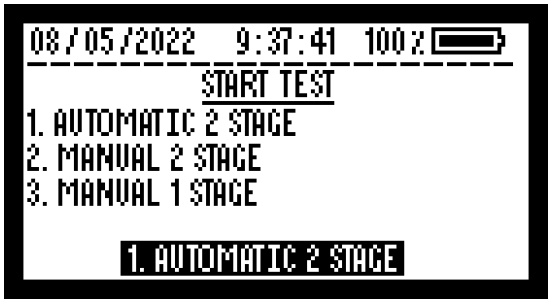

Figure 11. Start Test screen

6.4.1 Automatic 2-Stage

In the Automatic 2-Stage mode, the unit performs a leak rate measurement upon the user selecting **START,** upon which the measurement begins at first at a high flow rate for 1 minute, and then automatically shifts to a lower flow rate (70 – 80% of max. rate) and performs another measurement for another 1 minute. This mode is used to measure leaks that are easily identifiable and captured.

6.4.2 Manual 2 Stage

In the Manual 2-Stage mode, the user starts a measurement at a high flow rate, waits for a duration (usually longer than a minute) to attain a stable leak rate reading, and then manually switches to the lower flow rate by pressing **ENTER** to save. The unit then lowers the flow rate, at which time the user makes a second leak rate measurement that can be stopped at the discretion of the user by pressing **ENTER** to save & stop. This mode is used when additional control of the measurement process is required.

6.4.3 Manual 1-Stage

In the Manual 1-Stage mode, the user has the ability to adjust the flow rate as required using the **UP** ↑ and **DOWN** ↓ arrow keys. This mode is used when additional control of the measurement process is required such as measuring leaks at lower leak flow rates.

7. Measurement Process

When exiting the setting menu, the user views the main screen to begin the measurement process. The user can toggle the options here between **START** and **SETTINGS** using the ↑ or ↓ keys. The user initiates the measurement by pressing the **ENTER** key when **START** is displayed.

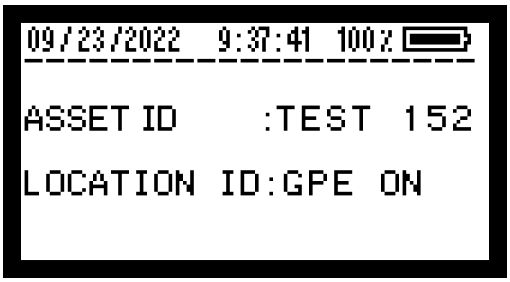

Figure 12. Data Logging Nomenclature

The user will be prompted with a message to **LOG DATA?**, upon which the user can toggle the options of **YES** or **NO** using the ↓ or ↑ arrow keys whether the instrument should record data that will eventually be outputted in an Excel spreadsheet. When selecting **NO**, the user must manually record the data when the results of the test are outputted on the display at the end of the measurement. If digital record of the data is desired, then select the option **YES**, which will prompt the user to input:

ASSET ID : XXXXXXXX
LOCATION ID : XXXXXXXX

Where **ASSET ID** requires the user to input the nomenclature of the asset which is being measured on and the **LOCATION ID** is the name of the facility in which the series of measurements are taking place. The **ASSET ID** will be displayed on the screen as well as on the digital output, the data log spreadsheet.

7.1 Start Test

The start test screen will appear after inputting the **ASSET ID** and **LOCATION ID** or when selecting **NO** at the **LOG DATA?** screen. There will be three options displayed for the user to select according to their preference of measurement modes as mentioned from *sections 5.4.1 – 5.4.3*.

1. Automatic 2 Stage
2. Manual 2 Stage
3. Manual 1 Stage

After selection one of the above options, the option highlighted will be **STOP** and this must be changed using the ↑ or ↓ keys for the option **START** to appear. Press the **ENTER** key to begin the test.

1. Automatic 2 Stage

The automatic 2 stage will begin with Stage 1 which is the high blower flow rate measurement that will last for 1 minute, followed by Stage 2 which is a lower blower flow rate (70-80% of the first stage) that will last for 1 minute. The results will be displayed at the end.

2. Manual 2 Stage

In cases where the user desires more control of the measurement over 2 stages, the Manual 2 Stage Mode is an available option. In this mode of operation, the user determines the time spent to gather a measurement of the emission for both stages. Upon satisfaction at the first stage the user must press the **ENTER** button to begin Stage 2.

3. **Manual 1 Stage**
   The Manual 1 Stage is used when a single stage measurement is desired with the ability to adjust the blower flow rate. The ↑ or ↓ keys can be used to select with a **HIGH** or **LOW** option. Then the user must select and enter **START** to begin a test as the default is the **STOP** option.

   The blower flow rate can be adjusted using the ↑ or ↓ keys that will change with an increment of 5% in comparison to full scale.

7.2 Result

Upon conclusion of the test, the higher value between $Q1_{LEAK}$ and $Q2_{LEAK}$ rate should be noted at the leak quantification flow rate of that measurement. Typically, this is $Q2_{LEAK}$ as the second flow rate takes in lesser air than the faster flow rate. The user must also ensure that the **1 – 2 (%)** is within 10% to ensure the accuracy of the test. The parameters as seen in *Figure 12* that are displayed on the screen are: Background Gas (%), Sample Gas (%), $Q1_{LEAK}$, $Q2_{LEAK}$, Temperature (°), Blower flow rate, and 1 – 2 (%).

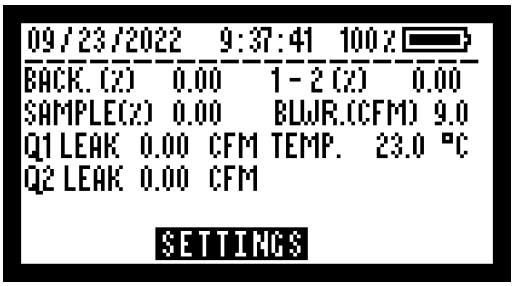

Figure 13. Sample Final Screen.

Please Note: The blower flow rate is with respect to the rate and mode at which the test concluded. It does not represent the average rate of the blower during the test.

8. Purge Mode

The purpose of this mode to manually purge the instrument in case the purge during start up is not adequate. This step will need to be performed when there is excessive gas in the area. The user can view the readings on the display until both sensors reach zero. It is recommended to perform this purge in a clean atmosphere as indicated by one's personal multi-gas monitor.

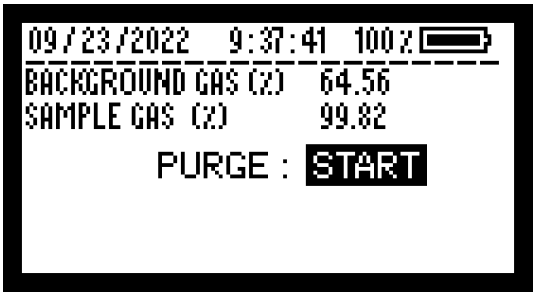

Figure 14. Purge Screen

9. Access Records

Data and calibration records that have been stored can be accessed on the display by selecting **"ACCESS RECORDS"** and selecting the appropriate record to view – either leak test or calibration records. The past six (6) records will be displayed on the screen, with the remaining records viewable on the spreadsheet once uploaded from the instrument to a computer.

Figure 15. Access Records

10. Upload Data – Instrument to Computer

Connect the USB cable with its USB-B connector into the **DATA PORT** located on the right side of the instrument and the USB-A connector into the computer. Turn ON the instrument using the ON/OFF switch. Follow these steps on the computer:

1. A window should appear on the screen stating "You need to format the disk in drive F: before you can use it. Do you want to format it? Please select Format Disk.
2. Select "Start" under Format USB Drive (F:)
3. A warning window will appear that will state "Formatting will erase ALL data on this disk. To format the disk, click OK, To quit, click, CANCEL.
4. A window will appear stating "Format Complete". Click OK. Click CLOSE.
5. The window should appear with either the **data_log** file or **cali_log** file. Only one file can be uploaded at a time, if a different file is desired then the user must access the menu of the instrument and select the option desired under **DATA UPLOAD**. Then unplug the USB and plug it back in and the desired file will appear in a window.

Figure 16. Data Upload of the Calibration Log

Btry#1(V)	Leak#1(degC)	Flow#1(cfm)	Back#1(%)	Leak#1(%)	Leak#1(cfm)
4.7	24.2	5.4	0	0	0
4.6	24.1	5.6	0	0	0
4.8	21.2	7	0	0.38	0.027
4.8	21.6	6.7	0	2.87	0.192
4.8	21.6	6.6	1.08	3.14	0.136
4.8	21.9	6.7	1.17	1.48	0.021
4.8	22	6.7	0.46	0.96	0.034

Figure 17. Sample Data Log File for Manual 1-Stage

11. Verification Test

A verification test can be performed with the Hetek Flow Sampler using the **VERIFY** function present in the sub-menu under **CALIBRATION**. See *Section 5.2* for more information.

Figure 18. Calibration Sub-Menu

The user can apply gas using a demand flow regulator to the **SAMPLE** and **BACKGROUND** ports after selecting the **VERIFY** option. The user may press the **ENTER** or **ESCAPE** key upon satisfaction.

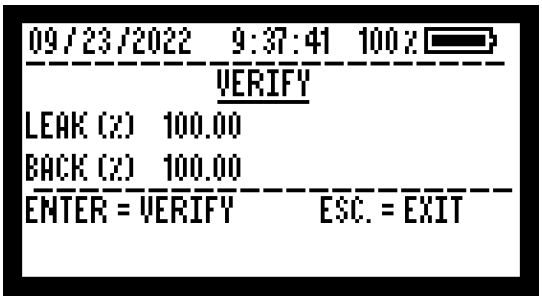

Figure 19. Verify Function

12. Calibration

A calibration must be performed every 30 days or after verification testing when it is discovered that the reading is beyond ±10% of the span or actual gas input. A calibration ensures the optimal performance of the instrument and its effectiveness in the field. The gases that are applied to the instrument's leak and background sensors are 2.5% of methane gas with a balance of air and 100% volume methane.

Please Note: Do not use a gas cylinder containing 2.5% volume of methane or natural gas with the balance of nitrogen as the sensor in catalytic mode relies on oxygen to function. Balance of air is desired. It is recommended to use a demand flow regulator with clear tubing to deliver gas to the instrument.

Gas should be applied to the ports on the top of the instrument: **SAMPLE** *(relates to the leak sensor)* and **BACKGROUND** *(related to background sensor)*, only one calibration to each port must be performed at a time. A two-point calibration will be performed for the two sensors:

- Background sensor at 2.5%
- Background sensor at 100%
- Leak sensor at 2.5%
- Leak sensor at 100%

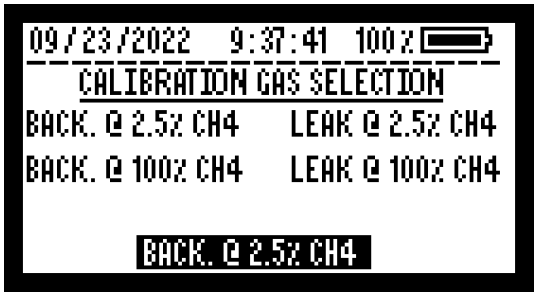

Figure 20. Calibration Gas-Sensor Selection

1. Before switching **ON** the instrument, ensure that the instrument is not connected to the calibration gases via either the **SAMPLE** or **BACKGROUND** ports, instrument should be switched on in clean air.
2. Turn **ON** the instrument and wait until the warmup sequences are completed.
3. Select **Calibrate Sensor**
4. Select the gas sensor to be calibrated
5. Using the ↑↓ keys, select the sensor to be calibrated along with its gas level. These keys can also be used to adjust the span or the applied gas concentration if the cylinder is of a different concentration than the default 2.5% and 100%.
6. Apply the calibration gas by connecting the tubing from the appropriate **SAMPLE** or **BACKGROUND** ports to the demand flow regulator that is connected to the gas cylinder. Begin the calibration process and the sensor pumps will draw the gas into the instrument.
7. Wait until the reading stabilizes.
8. Select **ENTER** to calibrate the sensor to the appropriate level. The status line should indicate "**Calibration Pass**" upon a successful calibration.
9. Disconnect the clear tubing and wait until the measured gas reading falls to zero.
10. Press **ESCAPE** to exit out to the sensor calibration menu.
11. Repeat this procedure to calibrate in other gas levels and sensors.
12. If the status indicates "**Calibration Fail**" then the calibration must be performed again, or the sensor will need to be sent to an authorized service centre for service.

The calibration record will be saved and digitally outputted as seen in *Figure 20* with a **PASS** or **FAIL.**

Record#	Instr.Serial#	Date(MM/DD/YY)	Time(HH:MM:SS)	Calibrated Sensor	Applied Value(%)	Measured Value(%)	Result
1	FS210101	9/29/2021	11:43:05	Back @2.5%	2.31	0	Fail
2	FS210101	9/29/2021	11:44:37	Back @2.5%	2.5	2.5	Pass
3	FS210101	9/29/2021	11:46:21	Back @100%	100	100	Pass
4	FS210101	9/29/2021	11:47:49	Leak @2.5%	2.5	2.5	Pass
5	FS210101	9/29/2021	11:49:01	Leak @100%	100	100	Pass

Figure 21. A typical calibrated record that is uploaded from the instrument.

Please Note: If a calibration has been incorrectly performed, then the calibration record can be eliminated with the "**Erase Previous Calibration Log**" option.

Figure 22. Erase of Previous Calibration Log

13. Battery Use

⚠ **WARNING:** Do not charge or disconnect the battery pack in a hazardous atmosphere. Store in a cool and dry area. Do not allow water to enter the battery housing and never submerge battery in water.

⚠ **WARNING:** Only use the Nickel-Cadmium battery (Hetek P/N: 1840-1003) and its associated standard battery charger (Hetek P/N: 1840-0100) supplied with the Hetek Flow Sampler. Alternates or misuse may result in bodily injury or death.

Please Note: It is a best practice to charge the battery from a low charge to full (indicated by the green light on the charger) and disconnect thereafter, for maximum battery life. The charger does not switch to trickle rate mode; thus, avoid leaving the battery in the charger longer than necessary.

⚠ **WARNING:** When changing batteries, use the rotating switch to turn the connected battery OFF first, prior to disconnecting it from the Hetek Flow Sampler. Similarly, the replacement battery must be in the OFF position when connecting it to the Hetek Flow Sampler.

The battery must be plugged into the 3-prong plug that is suspended from the instrument. Once plugged, the battery has a rotating switch as additional safety feature to turn it ON or OFF. It is advised to turn it OFF when the Hetek Flow Sampler is not in use.

- The battery is made of Nickel-Cadmium that can provide up to 500 charge/discharge cycles.
- Infrequently used battery packs should be fully charged, initially, then recharged periodically once the battery gets depleted to a low charge with time. This helps maintain battery integrity.
- Allowing a battery to self-discharge during extended storage will not harm the battery. Batteries subjected to prolonged storage (6 months or more) may lose their ability to hold a full charge.

- Battery capacity can be evaluated by operating the blower for four hours and checking hourly that the airflow is maintained at 6 CFM or greater. Several charge/discharge cycles may restore battery capacity.
- Only use the standard battery charger provided with the Hetek Flow Sampler. Connect the charger into a regulated 120v/60Hz outlet and then insert charging lead into the battery pack.
- The LED light on the charger will turn on, indicating that the battery is connected.

14. Errors and Troubleshooting

The following errors may appear over the course of using the instrument. The error code will be outputted in the spreadsheet, and the error message will be outputted on the display.

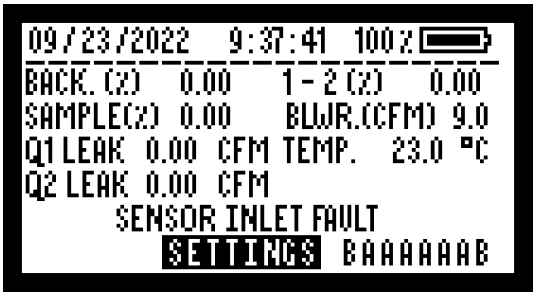

Figure 23. Status message on display with "Sensor Inlet Fault"

The list of their associated causes and solutions are given, however, if these errors persist then contact Hetek Solutions or its authorized repair centres for technical support.

Table 2 – Errors and Messages

Code	Error Message	Cause	Potential Solution
E	Sample Error	When the percent difference between Stage#1 and Stage#2 is greater than 10%	Perform an additional test or in manual mode
P	Sensor Inlet Fault	Blockage along the path to the sensor port	Turn off the instrument. Ensure filters are clean, removal of any physical obstacles. Turn on the instrument.
H	High Background Gas %	The background gas level is greater than the sample gas level	Repeat measurement after purging in a clean atmosphere
F	Sample Fault	Blockage along the flow path to the inlet sample port	Removal of any physical obstacles
Z	Check Sensor Zero	Sensor did not properly zero upon start-up	Purge in a clean area
C	Calibration Due	Duration of calibration is past 30 days	Perform a calibration
L	Leak Sensor Error	Sensor does not read 0 after repetitive manual purging in a clean atmosphere	Send to an authorized service centre
	Low Battery	Battery is less than 20% and all data must be saved prior to shutting down	Charge battery and replace with a fully charged one
	Memory Full	No space remaining	Download and then delete data log records on HFS

	Calibration Pass	Calibration Successful	
	Calibration Fail	Calibration Unsuccessful	Retry calibration or send to an authorized service centre

Please Note: When encountering incorrect readings such as 0 CFM as the blower flow rate appears to be operating correctly, please cycle power by switching the HFS OFF, then turning it ON again.

15. Manufacturing and Green Policy

The Hetek Flow Sampler is designed, manufactured, and assembled in North America at Hetek Solutions' manufacturing facility based in London, Ontario, Canada. The product supports the following:

- Environmental stewardship, combatting climate change, as it will be used to accurately measure emissions of a major greenhouse gas that will be reported for reduction or elimination by repair.
- Energy efficiency with a longer battery duration and life cycle. Minimal accessory and packing materials used thus reducing its carbon footprint by reducing its shipping weight and size.
- Low cost of ownership with high quality, durable and lightweight materials used when possible.
- Strengthening local economies by supporting production teams consisting of professional engineers, technologists, certified technicians, apprenticeships, and training opportunities. Electronic components designed and produced by OES Inc. based in London, Ontario.
- Promotion of fair wages, labour, and employment practices.

16. Authorized Service Centres

It is recommended to send the Hetek Flow Sampler to an authorized service centre annually for service. Contact Hetek Solutions Inc. for an authorized service centre located outside of Canada.

CANADA

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Website: www.hetek.com
Toll Free: 1 (855) 298 4473
Phone: (519) 659 1144
Email: customerservice@hetek.com

Fill out an RMA form for instrument service: http://www.hetek.com/repair-form/

Produced in Canada.